

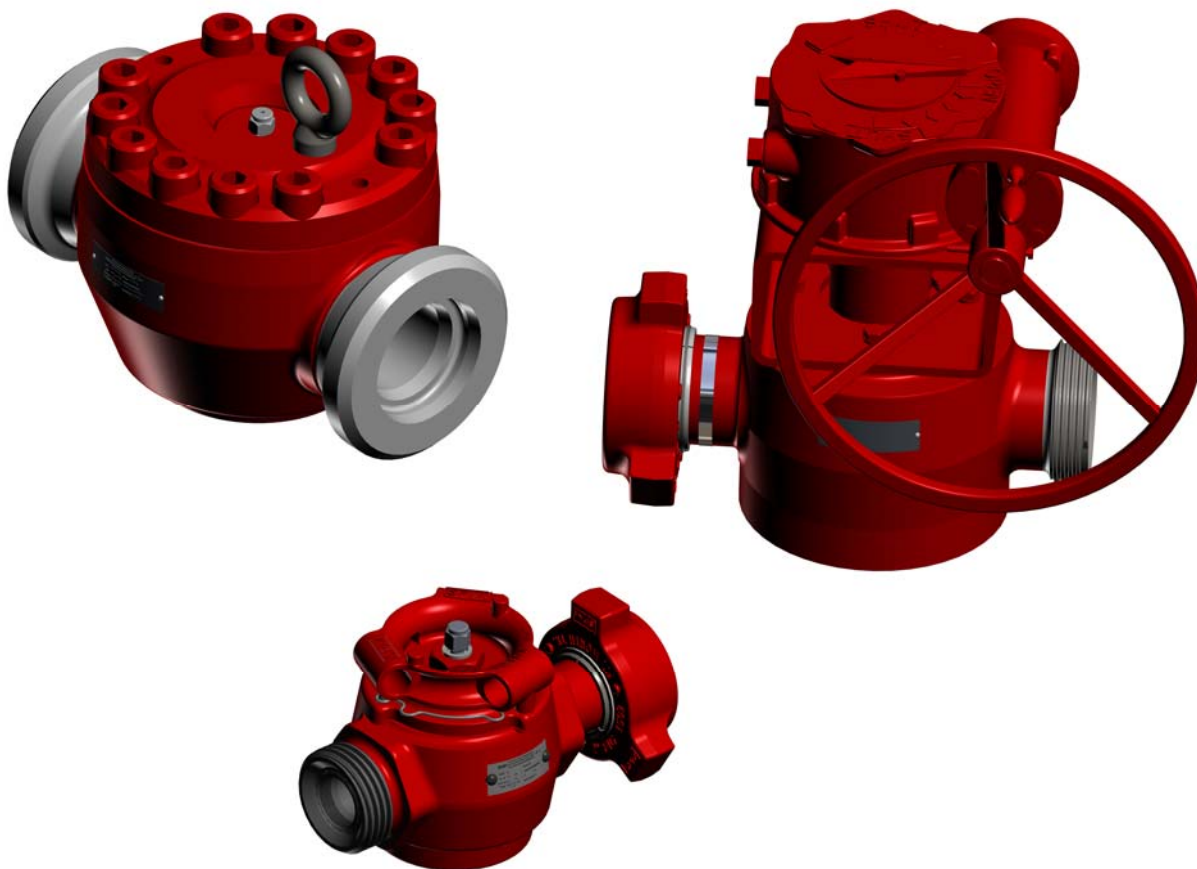
SPM®

Well Service Pumps & Flow Control Products

Plug Valves

Operation Instruction and Service Manual

Excellent
Oil & Gas
Solutions



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THE FOLLOWING ICONS DENOTE IMPORTANT INFORMATION WITHIN THIS MANUAL.



GENERAL INFORMATION



INSTALLATION AND OPERATION



MAINTENANCE AND REPAIR



SALES AND SUPPORT



NOTE



CAUTION



WARNING/ DANGER



WARNING: IMPORTANT SAFETY INFORMATION ENCLOSED. READ THIS OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL BEFORE OPERATING PRODUCT.



WARNING: THIS INFORMATION MUST BE AVAILABLE TO ALL PERSONNEL THAT WILL OPERATE AND MAINTAIN EQUIPMENT. FAILURE TO READ, UNDERSTAND AND FOLLOW THE OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH!

Most SPM® products generate, control or direct pressurized fluids; therefore, it is critical that those who work with these products be thoroughly trained in their proper application and safe handling. It is also critical that these products be used and maintained properly!!

SPM® flow products contain elastomeric seals and are not intended to provide proper functionality when exposed to fire.



WARNING: MISUSE, SIDE LOADING, IMPROPER MAINTENANCE, OR DISASSEMBLY UNDER PRESSURE CAN CAUSE SERIOUS INJURY OR DEATH!

The following information is given in good faith and should aid in the safe use of your SPM® products. This information is not meant to replace existing Company's safety policies or practices. It is important to read and understand the "General Safety Data for all SPM® Products" and the SPM® Product Safety Guide for "Union and Union End Products". Both of these are available from Weir Oil & Gas.

Safety Guide for Plug Valves:

Personal Responsibilities:

A-1 When using these assemblies, appropriate PPE is required: safety glasses, approved safety shoes and hard hat must be worn. Hammering and lifting these assemblies must be done with caution. Where unions are present, read and understand the SPM® Safety Guide for Unions and Union End Products.

A-2 Personnel should only hammer on makeup lugs and not strike union nut or valve body. Fractures can occur from repeated misuse. Excessive hammering can damage components.

A-3 Proper leg lifting should be used when lifting. Back lifts should be avoided.

A-4 Only the proper actuator bar should be used to turn SPM® plug valves. Valves require torque to operate. Makeshift bars can become dislodged easily and cause an accident. Use only an SPM® actuator bar, part number 3P19958 for 1" Plug Valves and 3P11542, for 2" & 3" Plug Valves. It is a personal responsibility to become knowledgeable and trained in the proper use and handling of this tool.

A-5 Do not hammer on, or be around valve assemblies when pressure is present.

Hand actuation (with the appropriate actuator bar) should be done only by specially trained personnel under direct supervisory instruction; and only when necessary due to application.

On Location:

B-1 Proper transportation of plug valves is important. Racks that will secure valves and prevent accidental unloading are critical. Never transport any SPM® product in a fashion that would allow it to become dislodged and cause an accident.

B-2 Valve unions should be clean and lightly oiled prior to each use. A visual inspection for damage should also be performed at this time. Union seals should be checked, and replaced when worn or damaged.

B-3 Each valve has a size and pressure code designated on the valve. Use this code for proper mating and pressure limits.



CAUTION: SINCE PLUG VALVES MAY BE REPAINTED IN DIFFERENT COLORS FOR VARIOUS APPLICATIONS, DO NOT USE FACTORY COLOR AS PRIMARY MEANS OF IDENTIFICATION.

B-4 Valve usage should be monitored by a qualified supervisor or foreman. Supervisory personnel must approve proper placement, position, and handling of all plug valves in the system. Only specially trained personnel under direct supervisory instruction, should actuate valves under pressure.

B-5 Prior to applying pressure, valves should be greased in both the opened and closed position. This should be done before each use. If valve is excessively hard to operate, it should be removed and not used until repairs are made.

B-6 It is sometimes necessary to turn valves when pressure is present. It is recommended that remote control actuators be used for this purpose. If this is not feasible, then only experienced specially trained personnel under direct supervisory instruction should perform this task.

B-7 Venting flammable or explosive gases to the atmosphere through individual SPM® plug valves must be avoided. Choke manifolds are available from Weir Oil & Gas and should be used for this purpose. If used for bleeding, ample anchoring of the valve manifold must be done. Specially designed torture valves are available from Weir Oil & Gas for bleed off applications.



WARNING: GASES, OR FLUIDS CONTAINING GASES, WILL CAUSE VALVES TO WHIP AND CAN CAUSE SERIOUS INJURY OR DEATH!

B-8 When opening an SPM® plug valve under pressure, the initial torque to start the stem turning is always greater than the moving torque. You must position your body to be able to compensate for this change.

B-9 Do not position any part of your body in the path of exit flow of the valve.

B-10 Do not position the exit of any plug valve, used for bleeding, where rocks or debris may be picked up by the exit stream.

B-11 If any valve becomes plugged, or does not operate properly, contact a supervisor immediately. DO NOT look into the end of the valve to check for debris, blockage, or for any other reason.

B-12 If valve is slow to open or close, remove it from service. Do not hammer on the valve's actuator cap.

B-13 It is recommended that a rate in excess of 42 feet per second be avoided. Rates above this will cause a more rapid wear and erosion.

B-14 Flush clean and grease after each job with water and the proper SPM® valve grease. Use only an SPM® pressure rated gun for greasing. Cycle valve to insure grease is evenly distributed.

Special Precautions:

C-1 Welding, brazing, or heating on SPM® plug valves is prohibited.

C-2 Valve operation sometimes requires personnel to be around pressured lines. Experienced personnel only should be dispatched for this purpose. Exposure time should be a minimum. Always use remote controlled valves whenever possible. Never look into, or position yourself in, the path of the exit flow of the valve.

C-3 Never alternate a valve's service. Acid service should never be followed by cold temperature service. When acid etching or erosion is present, replace the valve.

C-4 Weir Oil & Gas offers specially designed valves for torture service, cold temperature service, H2S service, and aromatic service. Only valves designed and approved for these special services should be used in these applications.

C-5 Each integral union connection is clearly marked with a pressure code (i.e. "1502", 15,000 psi). This pressure must not be exceeded. This code should also be used with mating unions. Improper mating can result in failures. All integral union connections must match (according to size, pressure rating, etc.). These connections must also match the service of the designated string they are installed in.

Inspection - Repair - Testing:

D-1 Valves should be greased after each use. Use only the following SPM® gun and grease.

Recommended Lube Grease: Valtex 972: SPM® P32553

Gun Assembly: SPM® P13335

 **(Do not mix Assembly Greases – This will increase the amount of friction between internal components of the valve. -- Contact Weir Oil & Gas Engineering for other approved grease)**

D-2 Any alteration of the SPM® valve is prohibited.

D-3 Use only repair methods as outlined by SPM® valve service literature. Use only the proper SPM® repair tools.

D-4 SPM® Repair Kits should be used for repair. Valve Body and all components must be clean and SPM® assembly grease used as recommended.

Recommended Assembly Grease: Val-Tex 1502 SPM® P36791

 **(Weir Oil & Gas does not recommend mixing competing types of assembly grease – This may result in reduced "tack" at the interface between each grease, and allow for an increase grease loss rate during pumping operations.)**

D-5 Weir Oil & Gas does not allow weld repair to be attempted on its product. Replacing worn components is a more effective and safe approach.

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SECTION I: General Information

This service manual covers:

| | | |
|----------------|----------|--------------------------------------|
| 1" & 1-1/2" | 1A12173 | PLUG VA/1 SP50TF |
| | 1A12174 | PLUG VA/1 SP150WU |
| | 1A11747 | PLUG VA/1X2 LPTLM |
| | 1A14483 | PLUG VA/1X2 SP150WU/LT |
| | 1A14483V | PLUG VA/1X2 SP150WU/LT/VIT |
| | 1A14483A | PLUG VA/1X2 SP150WU/AIR ACT/LT |
| | 1A19748 | PLUG VA/1X2 SP150WU/TORTURE/LT |
| | 1A19777 | PLUG VA/1X2 SP150WU/LT/H2S |
| | 1A25037 | PLUG VA/1X2 SP150WU/LT/LESS ACT/MOD |
| | 2A26276 | PLUG VA/1X2 SP150WU/HT/VIT |
| | 2A26270 | PLUG VA/1X2 SP150WU/HT/H2S |
| | | |
| 2" | 1A12477 | PLUG VA/2 SP50TF X 2 LPTL F |
| | 1A12478 | PLUG VA/2 SP100TF |
| | 1A12478 | PLUG VA/2 SP100TF |
| | 1A11742 | PLUG VA/2 SP150TF |
| | 2A26271 | PLUG VA/2 SP150WU/HT/H2S |
| | 1A14487 | PLUG VA/2 SP150WU/LT |
| | 1A14487A | PLUG VA/2 SP150WU/LT/AIR ACT |
| | 1A14492 | PLUG VA/2 SP150WU/LT/H2S |
| | 2A26277 | PLUG VA/2 SP150WU/HT/VIT |
| | 1A20211 | PLUG VA/2 SP150WU/LT/ACID SOLV |
| | 2A27973 | PLUG VA/2 SP150/SFTY IRN/LT/BUNA |
| | | |
| 3" | 2A26611 | PLUG VA/3 SP150/LT/MAN |
| | 2A27942 | PLUG VA/3 SP150/SFTY IRN/BUNA |
| | 2A27943 | PLUG VA/3 SP150/SFTY IRN/MANUAL/BUNA |
| | 1A14496 | PLUG VA/3 SP150/LT/GEAR |
| | 1A14496H | PLUG VA/3 SP150/LT/HYD ACT |
| | 1A18962 | PLUG VA/3 SP150/LT/LESS ACT |
| | 1A14496 | PLUG VA/3 SP150/LT/GEAR |
| | 1A14496H | PLUG VA/3 SP150/LT/HYD ACT |
| | 2A26611 | PLUG VA/3 SP150/LT/MAN |
| | 2A27942 | PLUG VA/3 SP150/SFTY IRN/BUNA |
| | 2A27943 | PLUG VA/3 SP150/SFTY IRN/MANUAL/BUNA |
| | 2A27943 | PLUG VA/3 SP150/SFTY IRN/MANUAL/BUNA |
| | 1A14496 | PLUG VA/3 SP150/LT/GEAR |
| | 1A14496H | PLUG VA/3 SP150/LT/HYD ACT |
| | 1A18962 | PLUG VA/3 SP150/LT/LESS ACT |

This service manual covers Cont:

| | | |
|----|-----------|---------------------------------|
| 4" | 2A28135 | PLUG VA/4 SP150/SBI |
| | 2A25168 | PLUG VA/4 SP150WU |
| | 2A25182 | PLUG VA/4 SP100/W ACT |
| | 2A25168 | PLUG VA/4 SP150WU |
| | 2A25182 | PLUG VA/4 SP100/W ACT |
| | 2A25168 | PLUG VA/4 SP150WU |
| | 2A25182 | PLUG VA/4 SP100/W ACT |
| | 2A25182HB | PLUG VA/4 SP100/HYD ACT/BRC2000 |

Rebuild Kits:

| | | |
|--------|----------------------------|---|
| 1" | PARTS KITS | |
| | 4L11769 | KIT/PARTS/PV/1.00 |
| | 4L16800 | KIT/PARTS/PV/1.00 ACID-SOLV NOT FOR H2S |
| | 4L20096 | KIT/PARTS/PV/1.00/TORTURE |
| | 4L20215 | KIT/PARTS/PV/1.00/TORTURE/ACID SOLV |
| | 4L20230 | KIT/PARTS/PV/1.00/H2S SP150 |
| | SEAL KITS | |
| | 4L14203 | KIT/SEAL/PV/1.00 |
| | 4L16783 | KIT/SEAL/PV/1.00/ACID-SOLV NOT FOR H2S |
| | 4L20094 | KIT/SEAL/1 PV/TORTURE |
| | 4L20214 | KIT/SEAL/PV/1.00/TORTURE/ACID SOLV |
| | ELASTOMER KITS | |
| | 4L20947 | KIT/ELASTOMER/PV/1.00 |
| | 4L20949 | KIT/ELASTOMER/PV/1.00/H2S/ACID-SOLV |
| | O-RING/PACKING ASSY | |
| | 4A11985 | SEAL&BKUP ASSY/1 PV |
| | 4A16802 | SEAL&BKUP ASSY/1 PV |
| 1-1/2" | PARTS KITS | |
| | 4L12487 | KIT/PARTS/PV/1.50/STD |
| | SEAL KITS | |
| | 4L14442 | KIT/SEAL/PV/1.50 NOT FOR H2S |
| | ELASTOMER KITS | |
| | 4L23926 | KIT/ELASTOMER/PV/1.50 |
| | O-RING/PACKING ASSY | |
| | 4L11979 | SEAL&BKUP ASSY/1.50 PV |

Rebuild Kits (Cont.)

| | | |
|----|-------------------------------|---|
| 2" | PARTS KITS | |
| | 4L11982 | KIT/PARTS/PV/2.00 |
| | 4L16826 | KIT/PARTS/PV/2.00/ACID-SOLV NOT FOR H2S |
| | 4L14522 | KIT/PARTS/PV/2.00/H2S |
| | 4L20574 | KIT/PARTS/PV/2.00/H2S/NO SIDE PORTS |
| | 4L13928 | KIT/PARTS/PV/2.00/SP200/H2S |
| | SEAL KITS | |
| | 4L13694 | KIT/SEAL/PV/2.00/STD |
| | 4L16824 | KIT/SEAL/2 PV/ACID-SOLV NOT FOR H2S |
| | 4L14989 | KIT/SEAL/PV/2.00/H2S SIDE PORTS |
| | 4L20575 | KIT/SEAL/PV/2.00/H2S/NO SIDE PORTS |
| | 4L19822 | KIT/SEAL/2 SP200 PV/H2S |
| | ELASTOMER KITS | |
| | 4L20948 | KIT/ELASTOMER/PV/2.00 |
| | 4L20950 | KIT/ELASTOMER/PV/2.00/H2S/ACID-SOLV |
| | O-RING/PACKING ASSY | |
| | 4A11979 | SEAL&BKUP ASSY/2 PV |
| | 4A16825 | SEAL&BKUP ASSY/2 PV/H2S |
| | 4A19829 | SEAL&BKUP ASSY/2 SP200 PV/H2S |
| 3" | PARTS KITS | |
| | 2A30675 | KIT/PARTS/PV/3.00/LT/SD |
| | 2A33786 | KIT/PARTS/PV/3.00/LT/SD/H2S |
| | 2A34110 | KIT/PARTS/PV/3.00/LT/SD/LESS SIDE SGMTS |
| | SEAL KITS | |
| | 2A30677 | KIT/SEAL/PV/3.00/LT/SD |
| | 2A33787 | KIT/SEALS/PV/3.00/LT/SD/H2S |
| | ELASTOMER KITS | |
| | 2A30678 | KIT/ELASTOMER/PV/3.00/LT/SD |
| | 2A33788 | KIT/ELASTOMER/PV/3.00/LT/SD/H2S |
| | O-RING/PACKING ASSY | |
| | 4A16827 | SEAL&BKUP ASSY/3 PV |
| | 4A20372 | SEAL&BKUP ASSY/3 PV/H2S |
| 4" | 4" PARTS KITS | |
| | 2A26353 | KIT/PARTS/PV/4.00/SP100 |
| | 2A26354 | KIT/PARTS/PV/4.00/SP150 |
| | | |
| | 4" SEAL KITS | |
| | 2A26358 | KIT/SEAL/PV/4.00/SP100 |
| | 2A26359 | KIT/SEAL/PV/4.00/SP150 |
| | | |
| | 4" ELASTOMER KITS | |
| | 2A26361 | KIT/ELASTOMER/PV/4.00/SP100 |
| | 2A26362 | KIT/ELASTOMER/PV/4.00/SP150 |
| | | |
| | 4" O-RING/PACKING ASSY | |
| | 2A26356 | SEAL&BKUP ASSY/4 PV |

Product Description:

SPM® Plug Valves are designed to regulate the transport of fluid through a flow line. By rotating the plug 90°, the flow can either be terminated, or allowed to flow through the Plug Valve Bore. They require minimum space, are simple to operate, exhibit a fast response, and add relatively little internal disturbance to the flow. Therefore pressure drop across the valve is low.

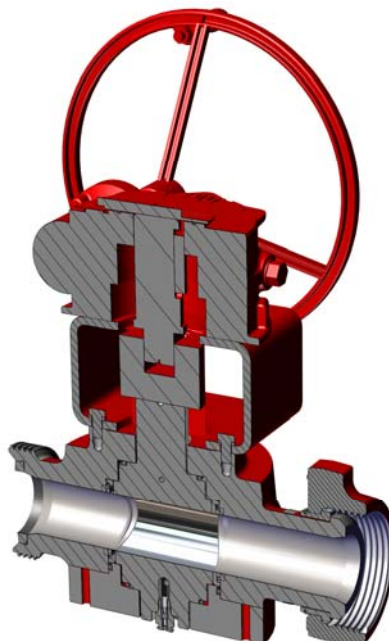
The valves are intended for both onshore and offshore use. Onshore, the plug valves are used in connection with mobile pumping service units used to kill wells, cement wells, acidize and fracture wells. They are also used in hydraulic lines to control wellhead protector tools. The lists of applications are lengthy. Offshore, the valves are used on stimulation vessels in a number of applications. They are used in essentially permanent installations in pump rooms to isolate the discharges of the triplex pumps used in fracturing wells. They have also been used in choke and kill manifold systems.

Operation is accomplished by a 90° rotation of the plug. This can be performed manually, or with pneumatic or hydraulic actuators

All SPM® Plug Valves are in compliance with the following regulations:

- Pressure Equipment Directive 97/23/EC.
- U.K. DEN SI 289
- Det Norske Veritas' Rules of Classification of Mobile Offshore Units
- API 6A, 16C Approved
- NACE MR0175-09 (H2S Exposure)

 **WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND PERSONAL INJURY OR DEATH!**



SPM® 1", 1" x 2", and 2" Plug Valves

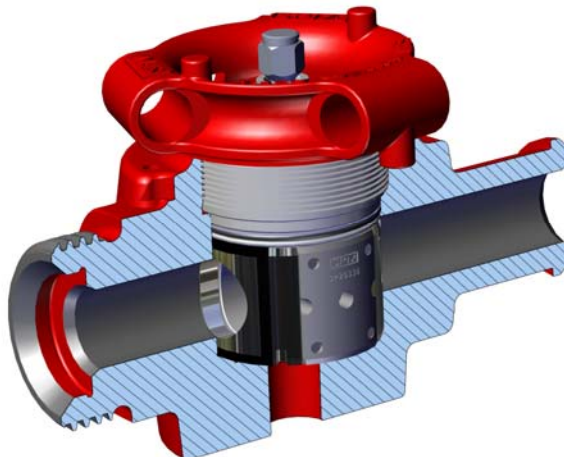
These plug valves are available for standard and H2S Service. The H2S Plug Valves conform to NACE MR0175-09 for exposure to H2S. It is important that the correct Plug Valve be used for the specific application.

Characteristics

- Improved body cap seal arrangement eliminates cap leakage found in some competitive valves.
- No need to remove valve from line for maintenance.
- No special tools needed for operation or maintenance.
- Precision-ground floating seal segments insure positive seal between fluid stream and cylindrical plug.
- Excellent sealing provided by precision ground metal-to-metal seal between seal segments and plug.
- Pressure-enhanced sealing between segments and body provided by molded rubber static segment seal.
- Segment design ensures easy operation up to the full working pressure of the valve.
- Precision-ground plug is plated standard for maximum corrosion protection.
- Quality components throughout unit including forged heat-treated alloy steel body for greater dependability, minimum weight and maximum strength.
- Plug bar cap has visible indication of open or closed position and detent spring to insure valve stays open or closed.
- Hydraulically-actuated models optional.
- Remote-control actuator available.
- Each valve is thoroughly tested prior to shipment.
- Inventory stock of complete valves, spare parts and seal kits available.

Can be used in the following service:

- Fresh Water and Sea Water Lines
- Drilling Mud Lines, including Choke and Kill Lines
- Well Service Lines for cementing, fracturing, acidizing, and flow testing
- Hydraulic Lines, including BOP control lines
- Crude Oil Production Lines
- Utility Lines



SPM® 2" Light weight Plug Valve

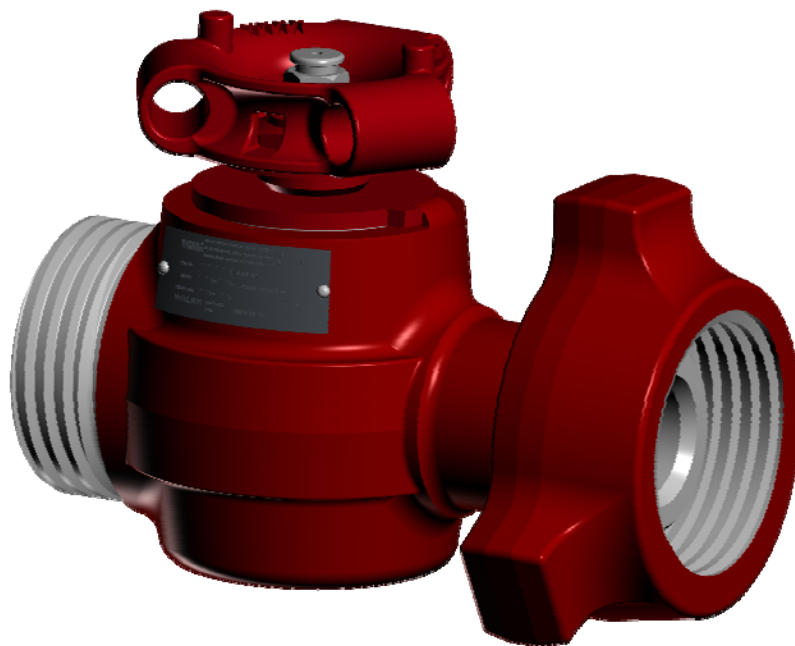
The SPM® 2" Light Weight (LW) Plug Valve is engineered with one thing in mind: Safety. It provides the following advantages to the Oil and Gas Industry:

- Compact/Lightweight Design
- Meets HSE Lifting Requirements*
- Easy Assembly/ Disassembly
- DNV Certification Available
- CE Compliant (97/23/EC)

*HSE compliant products offer a safe lifting weight of 55 lbs (25 kg) or less to be lifted and carried by one person.

Like other SPM® high pressure plug valves, the 2" LW Plug Valve is able to provide the same dependable service for applications such as:

- Acidizing
- Cementing
- Coil Tubing
- Fracturing
- Sand Control
- Well Kill



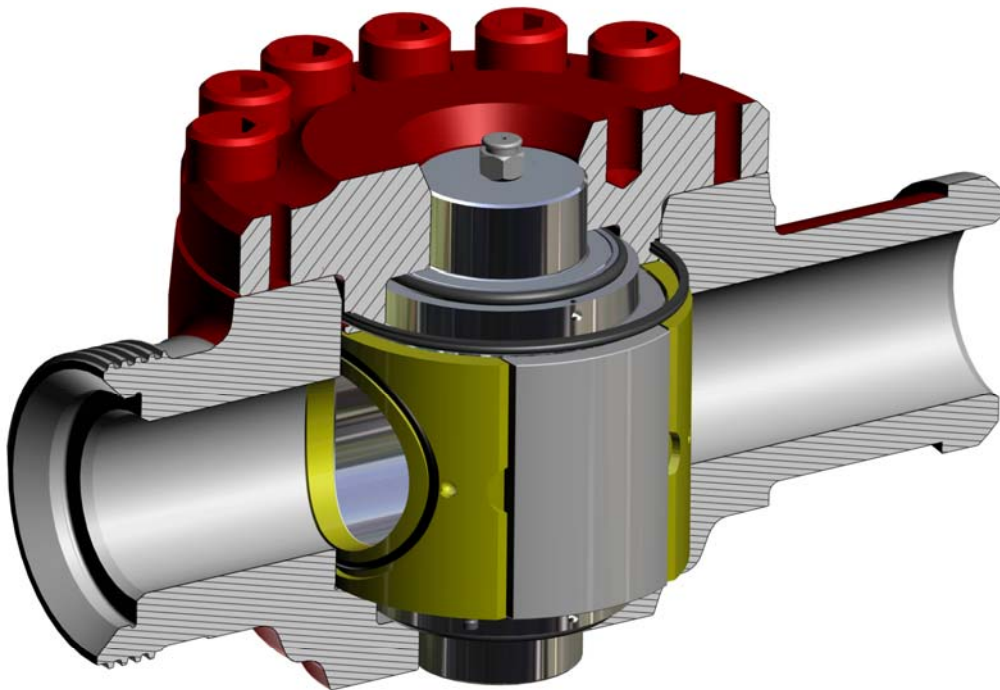
Refer to SPM® 2" Light Weight Plug Valve (HSE Approved) Operation and Maintenance Instruction Manual for further information on this valve.

SPM® 3" and 4" Plug Valves

SPM® three-inch and four-inch plug valves are available in pressure ratings to 15,000 psi NSCWP*. Features include a flanged body for easier maintenance, integral inlets and outlets, hand crank, locked-open and shut gear drive standard, and multiple lubricating inlets. Standard service and sour gas service models are available.

Characteristics

- Low operating torque due to balanced stem makes valve easier to operate.
- Flanged body for easier maintenance.
- Integral inlets and outlets are standard.
- Quality components throughout unit including forged steel body.
- Hand crank, and locked-open and shut gear drive is standard.
- Hydraulic and pneumatic actuators with either a 12-volt power system or hand-operated hydraulic pump are optional.
- New manual actuated design now available.
- Cylindrical balanced plug utilizes sealing segments to permit easier operation under pressure, and assure positive seal.
- Flanged body construction for safer operation and easier maintenance.
- No adjustments or special tools needed for maintenance or operation.
- Visible quarter-turn stop indicates when the valve is open or fully closed.



End Connection Options:

The SPM® Plug Valve family is available with SPM® Wing Union or Safety Iron™ connections. The nameplate will indicate the allowable cold working pressure for each assembly.

Wing union connections on the plug valve are interchangeable with other union connections of the same size and figure (pressure rating). Caution must be taken to avoid mixing different ratings of wing connections. There are various sizes and figures that are capable of making marginal connections. SPM® Safety Iron™ connections are universal requiring no male or female as does the wing union. Failure to observe good judgment may lead to failure of components and danger to life and limb. Always verify working pressure ratings of each connection before use.

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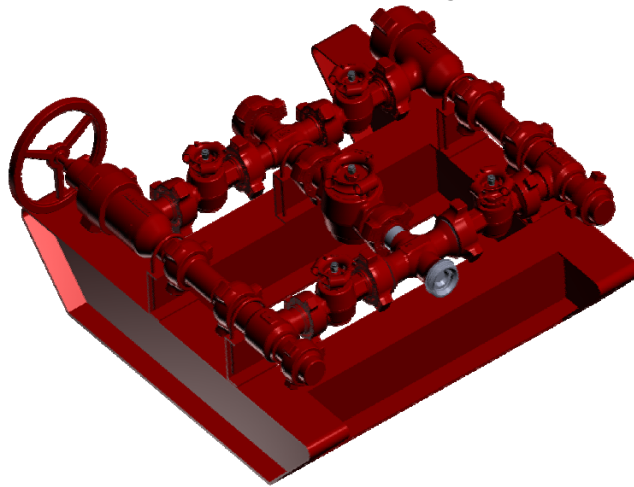


SECTION II: Installation and Operation

Installation

1", 1" x 2", 1½" and 2" Plug Valves

SPM® Plug Valves in these sizes are primarily installed in line of a flow back system on a fracturing site, Manifold Assemblies, or any other location that a plug valve with this rating and capacity is needed. The important thing is to ensure that the size of the plug valve meets the correct application. Figure below shows a SPM® Flowline Manifold, which consists of Plug Valves, Tees, Crosses and Chokes.



WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND **PERSONAL INJURY OR DEATH!**

3" and 4" Plug Valves

3" and 4" Plug Valves are installed in line with the High Pressure Fracturing Lines or Manifold Trailers, however other applications may apply. Figures below show Plug Valves installed on a SPM® Manifold Trailer and used as an isolation valve on a SPM® Emergency Back Pressure Relief Valve.



Calibration Guide:

Refer to Vessel Testing Section on page 32.

Pressure/Temperature Ratings:

| Part Number | Description | Service | Working Pressure (PSI) | Temperature Range (F) | |
|-------------|-----------------------------|---------|------------------------|-----------------------|-----|
| 1A14483 | 1" X 2" SP150 WU LT | STD | 15,000 | -30 | 110 |
| 1A13280 | 1" X 2" SP150 WU LT/VITON | STD | 15,000 | -30 | 110 |
| 1A19777 | 1" X 2" SP150 WU LT | H2S | 10,000 | -30 | 110 |
| 1A19748 | 1" X 2" SP150 WU TORTURE LT | STD | 15,000 | -30 | 110 |
| 1A20855 | 1" X 2" SP150 WU TORTURE LT | H2S | 10,000 | -30 | 110 |
| 1A11687 | 2" SP150WU | STD | 15,000 | 0 | 110 |
| 1A13279 | 2" SP150WU LT/VITON | STD | 15,000 | -30 | 110 |
| 1A14492 | 2" SP150WU LT | H2S | 10,000 | -30 | 110 |
| 2A27270 | 2" SP150SI LT/SAFETY IRON | STD | 15,000 | -30 | 110 |
| 1A14802 | 2" SP200WU LT | STD | 20,000 | -30 | 110 |
| 1A14498 | 3" SP100WU LT | STD | 10,000 | -30 | 110 |
| 1A14174 | 3" SP100WU LT/VITON | STD | 10,000 | -30 | 110 |
| 1A14496 | 3" SP150WU LT | STD | 15,000 | -30 | 110 |
| 1A13278 | 3" SP150WU LT/VITON | STD | 15,000 | -30 | 110 |
| 1A19585 | 3" SP150WU LT | H2S | 10,000 | -30 | 110 |
| 2A27942 | 3" SP150SI LT/SAFETY IRON | STD | 15,000 | -30 | 110 |
| 2A25154 | 4" SP100WU LT | STD | 10,000 | -30 | 110 |
| 2A25168 | 4" SP150WU LT | STD | 15,000 | -30 | 110 |
| 2A25175 | 4" SP150SI LT/SAFETY IRON | STD | 15,000 | -30 | 110 |

 **WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND PERSONAL INJURY OR DEATH!**



SECTION III: Maintenance and Repair



WARNING: DISASSEMBLY UNDER PRESSURE CAN CAUSE SERIOUS INJURY OR DEATH!

ALWAYS REMEMBER:

1. DISASSEMBLY UNDER PRESSURE CAN CAUSE SERIOUS INJURY OR DEATH.
2. Clean all components thoroughly prior to reassembly using protective clothing and safety glasses (wear appropriate PPE).
3. Check sealing areas of segments, plug and body for pitting or erosion. Failure in sealing can result if these areas are not smooth.
4. Reassemble with quality valve assembly grease.
5. Use seal segments in pairs from the same manufacturer.
6. Use only SPM® body caps and actuator caps with SPM® valves.
7. Pressure test in accordance with instructions given in every repair kit prior to putting the valve into service.
8. Flush and grease valve thoroughly after each use.

Required Tools:

1. 400 Grit Sandpaper
2. Soft Face Mallet
3. Grease Gun (SPM® P13335)
4. Val-Tex 1502 (Temp Range -20F to 400F) SPM® P/N P36791 (For Re-greasing)
5. Val-Tex 972- (Temp Range -20F to 600F), SPM® P/N P32553 (For assembly)
6. Appropriate PPE for your company; Safety Glasses, Steel Toe Boots, Gloves, Protective Clothing
7. Special tool for specific SPM® valve size: Body Cap Wrench- 1" valve (SPM® 2P12258), 2" valve (SPM® 2P12259), 3" valve (3/4-inch allen wrench)


Maintenance Requirements:

SPM®'s Plug Valves are made from high quality materials selected to provide the best service to the customer. However, the application of this product subjects it to handling fluids which are by their very nature corrosive and abrasive. These fluids operate at high velocities and usually at high pressures. Some fluids may also require being conveyed at elevated temperatures. Combinations of any and all of these conditions will speed up the deterioration of internal surfaces including seals and seal surfaces.

Without the benefit of scheduled maintenance to routinely service and inspect the condition of components, premature failure of parts can occur. This can lead to unnecessary material replacement along with the danger of injury to personnel.

Proper knowledge and application of the plug valve is necessary for safe operation. It is recommended that a routine maintenance program include, at the very least:

1. Inspection of wall thickness loss
2. Routine replacement of o-rings and seals
3. Scheduled greasing of the Plug Valve after every fracturing job with recommended lubricants:
 - Val-Tex 1502 (Temp Range -20F to 400F) SPM® P/N P36791
 - Val-Tex 972- (Temp Range -20F to 600F), SPM® P/N P32553

 **(Do not mix Assembly Greases – This will increase the amount of friction between internal components of the valve. -- Contact Weir Oil & Gas Engineering for other approved grease)**

Frequent greasing will prevent the voids from occurring and will ensure easy operation of the valve. Please reference "Recommended Greasing Procedure" on Page 20.

Once the plug valve body wall thickness falls below the minimums listed in Engineering Specification 1S19644 for Standard Service and 1S23257 for H2S Service flow products, it must be removed from service. Wall thickness may be measured by mechanical, sonic, or visual means.

Maintenance Requirements (Cont.):

Weir Oil & Gas recommends that the valve be serviced during the following:

1. Preventative Maintenance (After every Frac and/or stage job)



Re-greasing the Plug Valve after every Fracturing and/or stage job will increase the life of the Plug Valve. Normal working operations will allow for grease loss if the plug valve is not maintained. This can create voids within the assembly. These voids will quickly accumulate sand and proppants thus increasing the force required to open/close the valve. Frequent greasing of the valve will ensure easier operation.

Reference – “Recommended Re-Greasing Procedure” beginning on page 20.

2. Periodic Inspection

Periodic inspections are required to ensure that all internal components of the valve are working properly and are to Weir Oil & Gas Engineering’s specifications. It is imperative that a qualified Weir Oil & Gas Technician follow the assembly/disassembly/inspection instructions beginning on page 25.

Rebuild Kits are available through Weir Oil & Gas Service Centers. They are referenced on pages 8 & 9.

Periodic Inspection will include recertification of the Plug Valve which will include the following:

- Inspection of sealing surfaces, evidence of wear and pitting of all components.
- Disassembly
- New Kitting
- Ultra-Sonic Inspection / Minimum Wall Inspection
- Reassembly
- Pressure testing to 100% the product’s normal working pressure per SPM® Specification 4S12497 Section
- Magnetic Particle Inspection (Per Request)

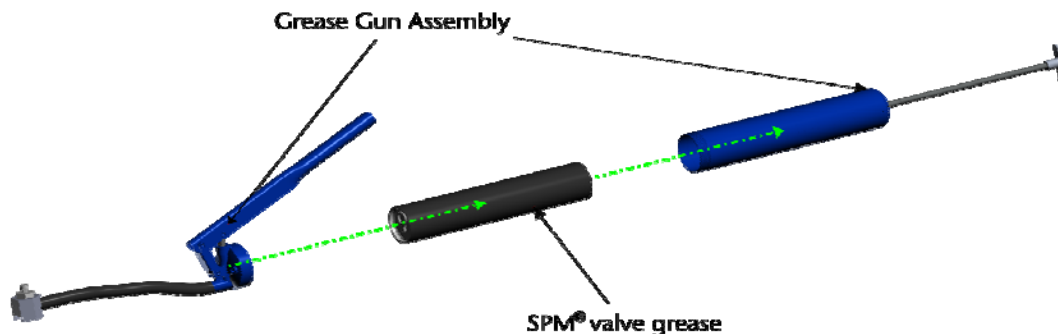
Recommended Re-Greasing Procedure:

To maximize the valve's performance and longevity, it is recommended that the lubrication maintenance procedure described below be followed. Safety

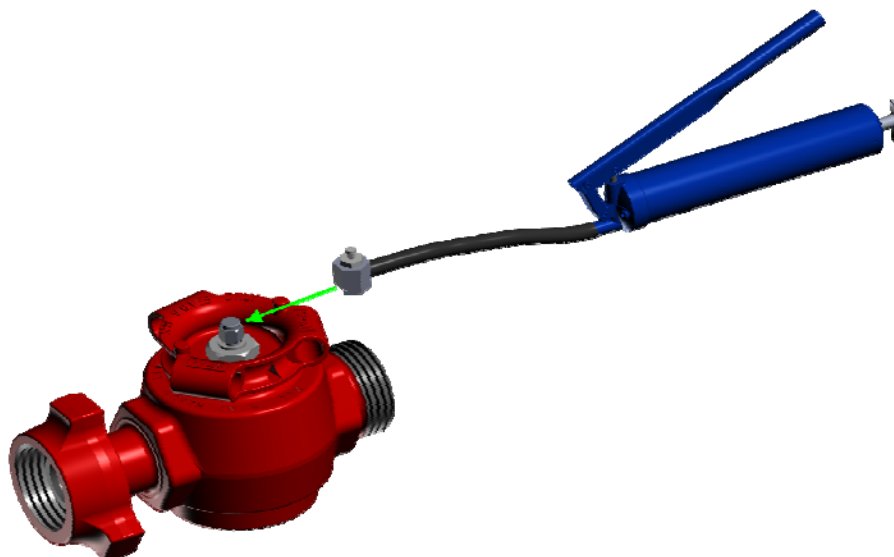
Note: Always wear proper PPE equipment while performing work on any valves.

1A. After each job, flush valve with clean water to wash away any contaminants in the valve.

1B. After each job, grease with approved SPM® valve grease to displace contaminants in between valve's internal components. Engineering recommends using Val-Tex 1502 Assembly Grease whenever disassembly of the valve is required. Roll the plug to completely coat the O.D. of the plug. Grease the O.D. surfaces of the seal segment. Reassemble Valve using new seal components.

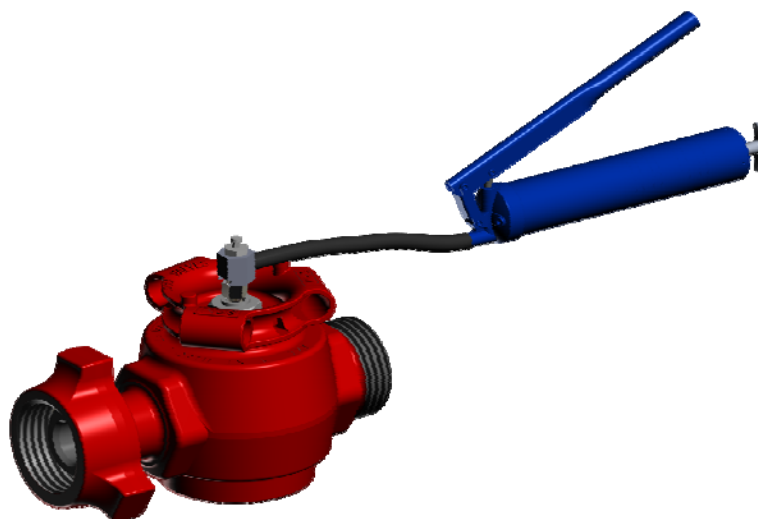


2. Slide the grease gun fitting over the valve's grease fitting.
3. Make sure the valve is in the OPEN position prior to pumping the grease.



Using the grease gun, pump the lever in order to push the grease into the valve. Val-Tex 972 (SPM® Part Number P32553) stick grease is recommended. Caution: Do NOT mix greases between different manufacturers.

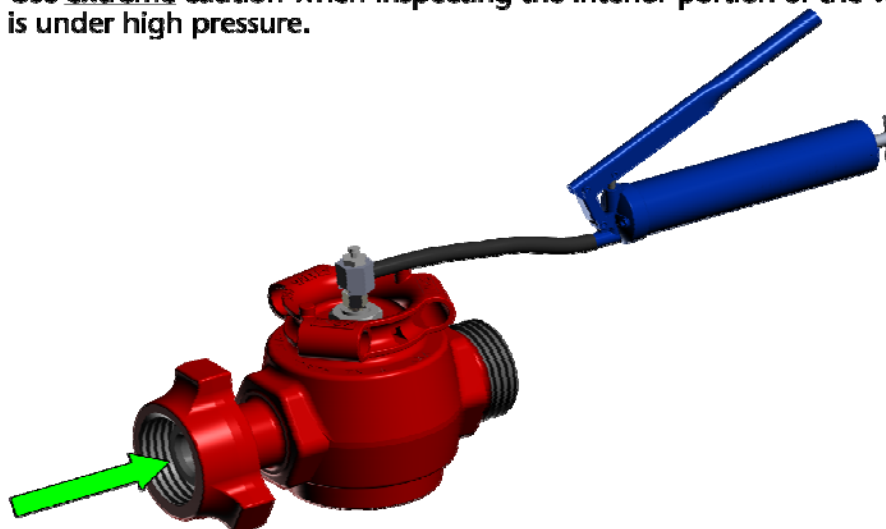
Alternatively, use a heavy duty pneumatic grease gun. SPM® p/n P28682



4. Keep pumping the grease gun until you can see the grease expanding around the plug. Inject a minimum of 6,000 psi to insure proper filling of valve. (gauge reading on pneumatic grease gun)

5. Visually inspect inside the valve to ensure the grease is extracting around the sides of the plug.

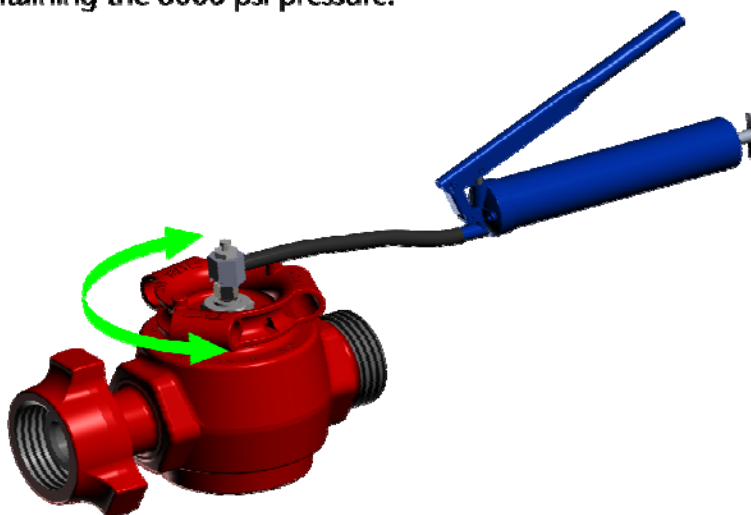
NOTE: Use extreme caution when inspecting the interior portion of the valve for grease is under high pressure.



6. Close the valve and reopen it.

NOTE: Air will be heard "popping" during opening and closing and allow more complete filling of grease in the valve assembly.

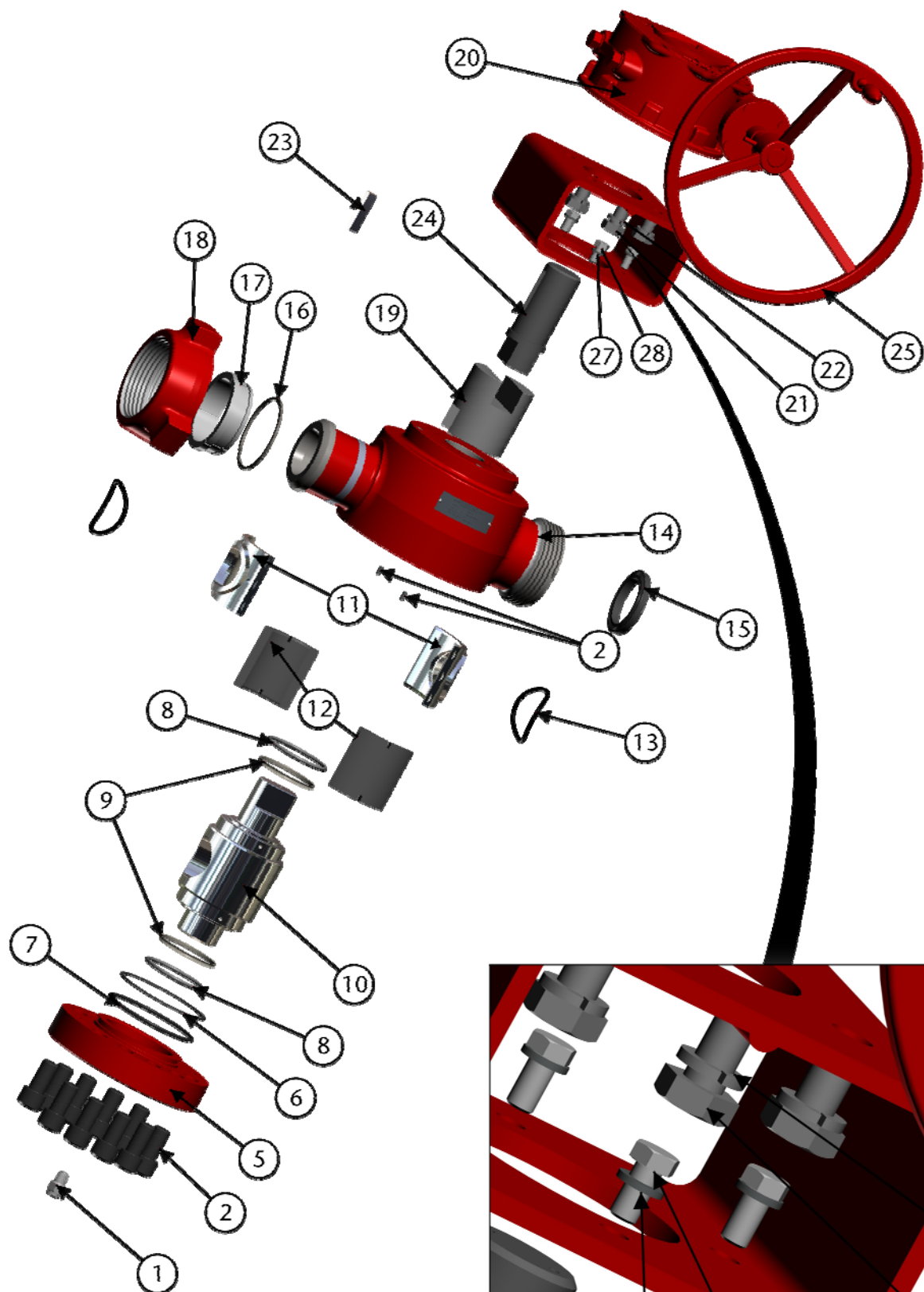
Repeat the above grease process two more times to insure complete valve filling while maintaining the 6000 psi pressure.



BOM Table:

| 1A14496 BOM | | | |
|-------------|------|-------------|-------------------------------------|
| BOM ID | Qty. | Part Number | Description |
| 1 | 1 | P10064 | Grease Fitting |
| 2 | 10 | P18258 | 1"-8NC x 2.00 Socket Head Cap Screw |
| 3 | 2 | P11694 | Grooved Pin |
| 5 | 1 | 2P14494 | End Plate |
| 6 | 1 | P13008 | Ring Backup |
| 7 | 1 | P12851 | Seal |
| 8 | 2 | P12850 | Seal |
| 9 | 2 | 3P12840 | Backup Ring |
| 10 | 1 | 1P14495 | Plug |
| 11 | 2 | 2P27074 | Seal Segment |
| 12 | 2 | 3P10013 | Side Segment Casting |
| 13 | 2 | P103884 | Segment Oring |
| 14 | 1 | 1P14493 | Plug Valve Body |
| 15 | 1 | 4P10258 | Union Seal |
| 16 | 1 | P10261 | Retainer Ring |
| 17 | 3 | 3P10260 | Retainer Segments |
| 18 | 1 | 2P10257 | Wing Nut |
| 19 | 1 | 2P10875 | Adapter |
| 20 | 1 | 2P36354 | Gear Operator Assembly |
| 21 | 1 | P11036 | Mounting Adapter Bolts (Upper) |
| 22 | 1 | P11037 | Mounting Adapter Washers (Upper) |
| 23 | 1 | P11040 | Adapter Key |
| 24 | 1 | 2P36662 | Adapter |
| 25 | 1 | 2P36356 | Handwheel (16") |
| 26 | 1 | 2P24223 | Mounting Adapter |
| 27 | 1 | P12461 | Mounting Adapter Bolts (Lower) |
| 28 | 1 | P10456 | Mounting Adapter Washers (Lower) |

Exploded View:



Preventative Maintenance and Disassembly:



WARNING: ENSURE ALL PRESSURE IS RELIEVED PRIOR TO PERFORMING ANY MAINTENANCE OR DISSASSEMBLY!

See "ALWAYS REMEMBER" Section on page 17 before assembly.
The reassembly of the valve is in approximate reverse order to the disassembly process.
Lightly lubricate all surfaces prior to assembly with assembly grease SPM® p/n P36791



WARNING: OBSERVE ALL INSTRUCTIONS, CAUTIONS, AND WARNINGS AS NOTED IN THIS MANUAL. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE AND **PERSONAL INJURY OR DEATH!**

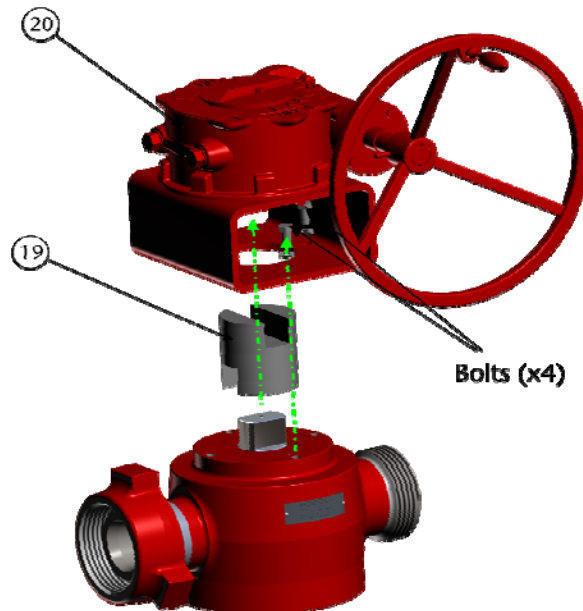


CAUTION: Make sure there is no pressure on the valve !!!

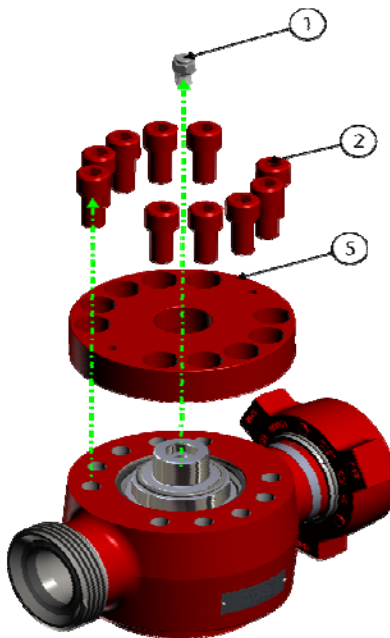
1. If valve has gear actuator assembly, remove assembly (20) by removing bolts and lifting off assembly.



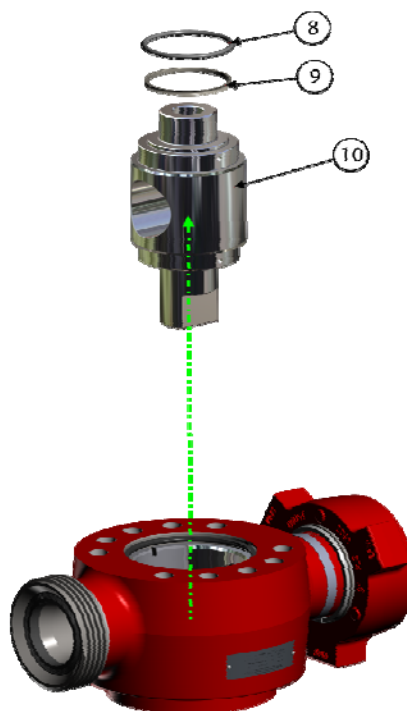
CAUTION: A hoist will be required to lift actuator assembly. Always use proper lifting techniques.



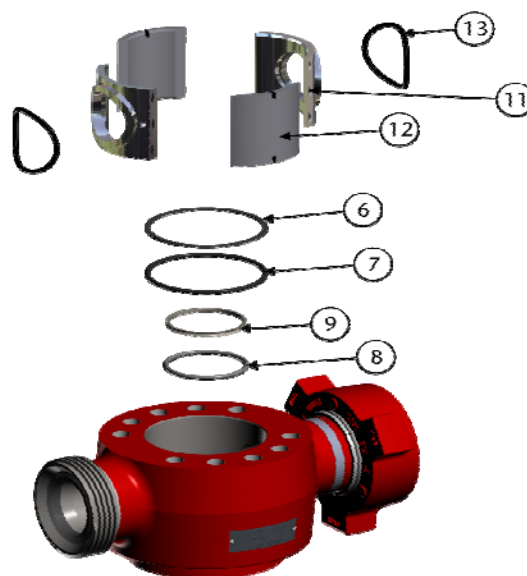
2. Remove the grease fitting (1)
3. Remove Bolts (2)
4. Remove top plate (5)



5. Remove the plug (10) by lifting, while twisting it back and forth. Sometimes it is necessary to hammer slightly from the bottom to remove.



6. Remove the side segments (12) and then the seal segments (11).
7. Remove the segment seal rings (13), plug seal rings (8), and back-up rings (9), body cap seal ring (7) and back up ring (6), if installed.
8. Clean all grease and foreign material from the valve and components parts.

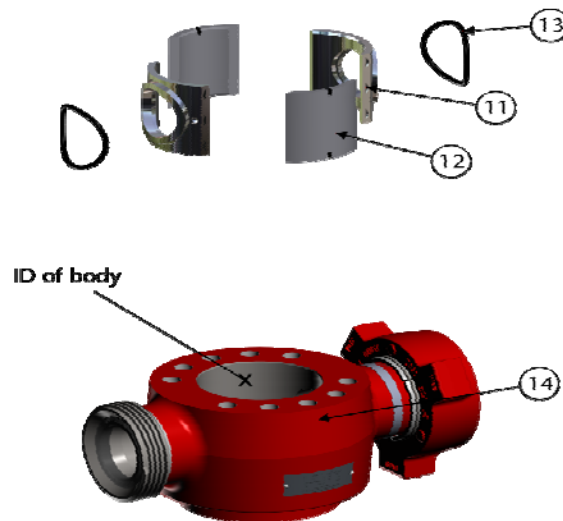


Assembly:

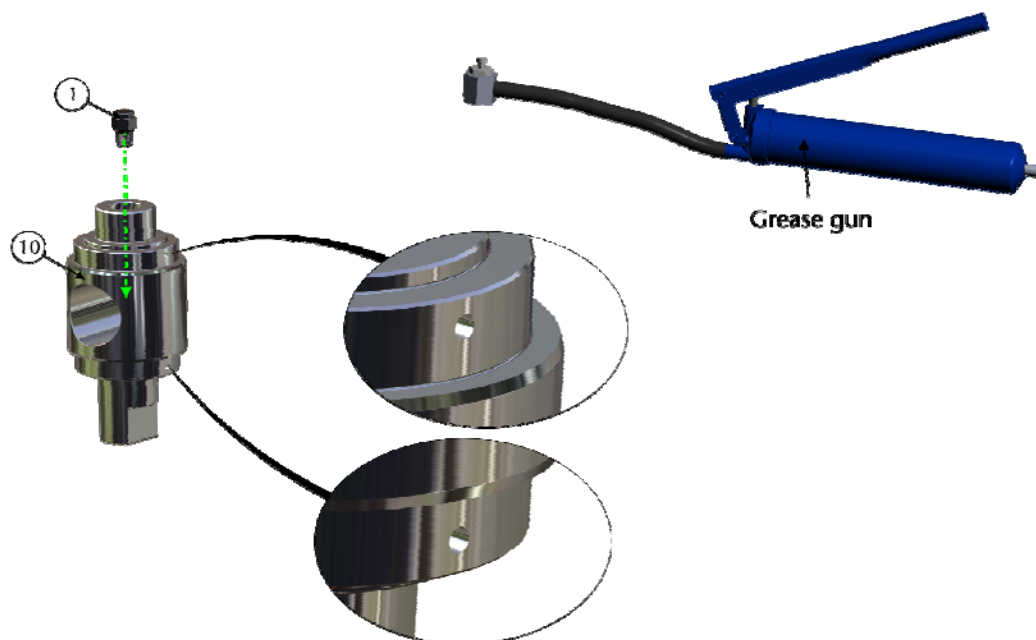
1. For best results and most efficient use of time, Weir Oil & Gas recommends complete kit replacement. If any old internal parts are to be reused; degrease, and inspect components for wear and corrosion.
2. If using old side segments and seal segments, thoroughly clean rust from sealing areas of seal segments that contact the plug and body. Scrape and lightly sand rust (with 400 grit sandpaper) from valve body surfaces which touch the center portion of the seal segments.
3. Using 400 grit sandpaper, clean all other seal surfaces.
4. Visually inspect all new parts and remove any foreign contaminants.

5. Apply a thin film of assembly grease on OD of seal segments (11), seals (13) and ID of body (14). If excessive grease is used, it can make the plug hard to start or dislodge the segment seal rings.

6. Install seals (13) in seal segment grooves and install seal segments and side segments (12) in valve. Seal segments should always be installed in pairs from the same manufacturer.

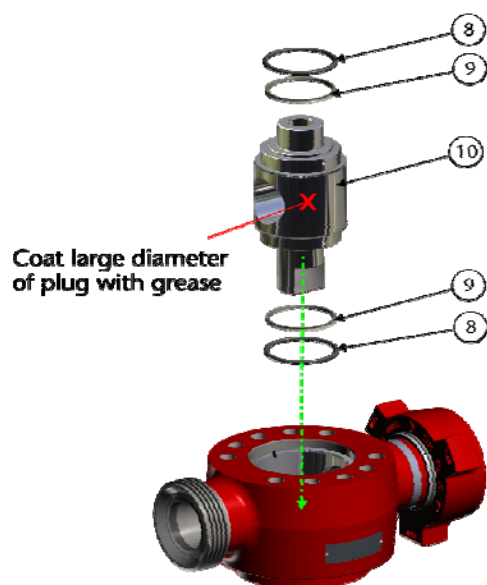


7. To test passages, install grease fitting (1) into plug (10); tighten 50-60 ft.lbs. Pump grease into plug until clean grease exits grease passages.



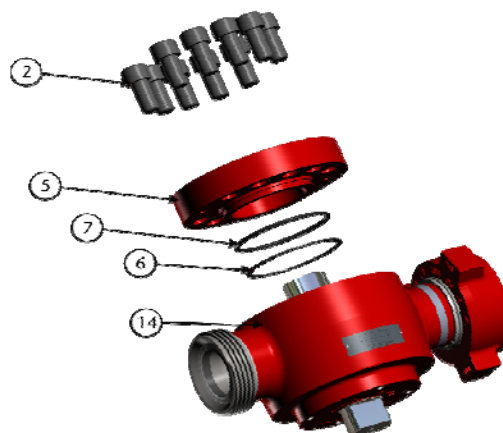
8. Coat plug (10) liberally with assembly grease and install top and bottom plug seals (8), and nylon back-up rings (9).

9. Install plug (10) into valve. You should be able to install plug by hand. If necessary a soft face mallet may be used to lightly tap plug in.

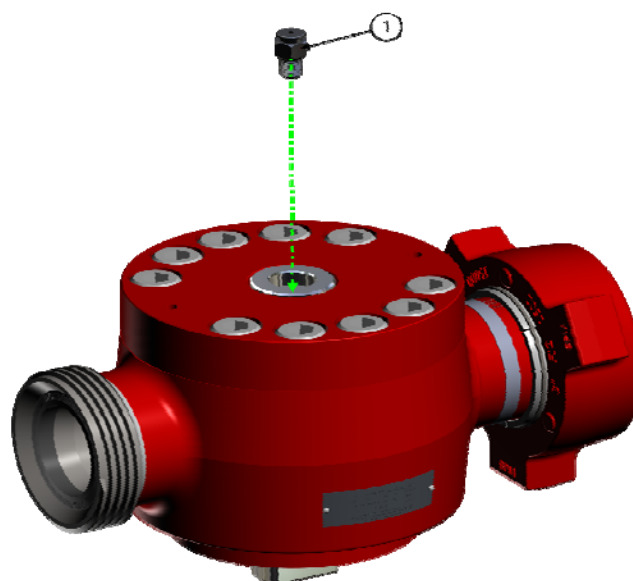


10. Install body cap seal (7) and back-up ring (6), where required, onto body cap (5) with valve assembly grease.

11. Install body cap in valve. Use only SPM® body caps in SPM® valves!
On 3" valve, socket head screws are to be torqued to 475 ft. lbs. (dry), 355 ft. lbs. (lubricated).

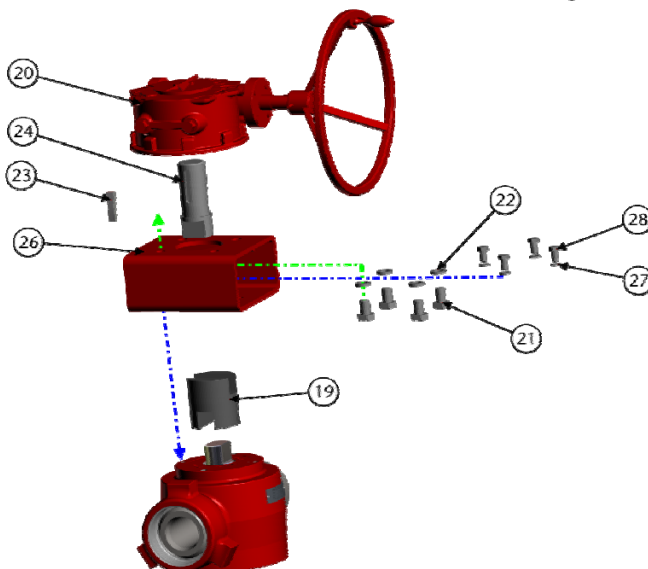


12. Replace actuator cap and felt gasket (when required). Install grease fitting (1) using Teflon tape or pipe dope and tighten to 50-60 ft. lbs. Tighten stop nut (2) until snug (when required).
Use only SPM® actuator caps on SPM® valves!



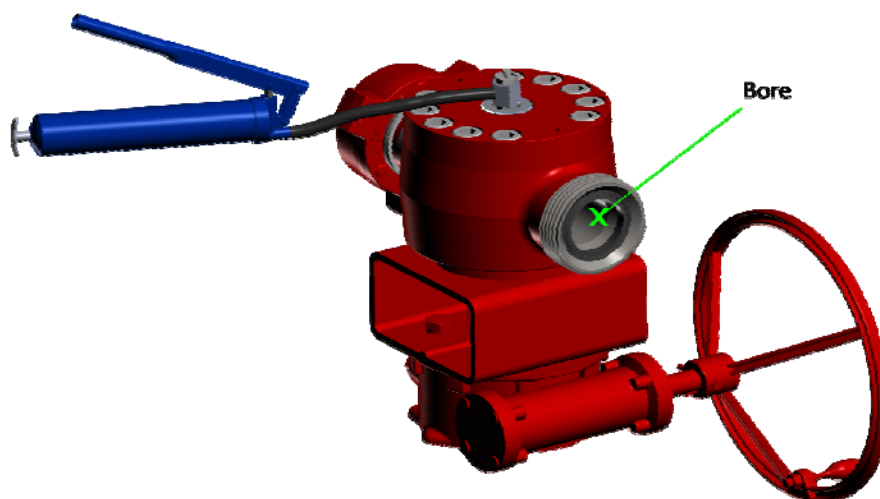
13. Install and bolt actuator assembly onto valve body (when required)
Install adapter key (23) into adapter (24) and both into operator assembly (20).
Install mountint adapter (26) onto operator assembly (20). Install upper washers and bolts (21, 22).

14. Install adapter (19) onto plug valve. Lower gear operator assembly (20) onto plug valve. Install lower washers and bolts (27, 28) and tighten.



15. With valve in the open position, pump valve full of grease (Usually 15 to 20 pumps is sufficient). The valve is full when grease flows from bore.


16. Test valve per instructions included in every repair kit.



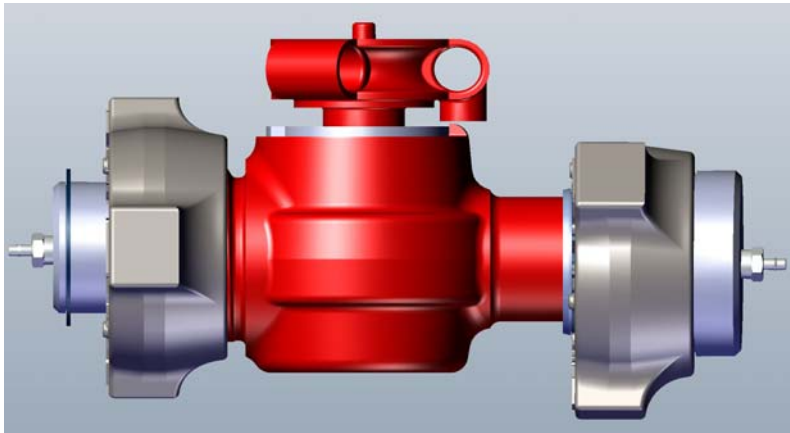
Test Procedures:

Prior to shipment, product testing procedure 4S12497 requires that each emergency valve pass a one time vessel test at 150% it's rated working pressure; then, when conducting subsequent vessel tests on used or re-certified valves, limit the pressure to 100% of rated working pressure as required by 4S12497.

Upon final assembly or reassembly of valve, a pressure test is to be performed as follows:

 **CAUTION:** PRIOR TO ANY PRESSURE TESTING ALL AIR MUST BE EVACUATED FROM THE VALVE AND PRESSURE APPARATUS. FAILURE TO DO SO COULD RESULT IN PERSONNEL INJURY OR DEATH AND/OR SEVERE DAMAGE TO THE VALVE.

1. Both ends of the valve are to be capped. Both caps must have pressure access ports as shown in the figure below. Valve is to be tested so as to have pressure applied to both sides of plug - hence the need for pressure access ports at both ends of the plug.



Pressure Access Ports

2. With caps in place and valve in the "OPEN" position and filled with liquid - (all air must be evacuated from valve at this point) - pressure valve slowly to maximum working pressure and inspect for visible signs of leakage, or failure to maintain pressure at the gauge.
3. Reduce pressure to zero and place valve in "CLOSED" position.
4. With the valve in "CLOSED" position - (again air must be evacuated from valve and system) - apply pressure slowly to one side of the valve, leaving the opposite side open, to a pressure equal to the maximum non-shock cold working pressure of the valve and maintain for a period of at least 3 minutes. Reduce pressure to zero. Open and shut the valve. Re-pressurize the valve to its maximum non-shock cold working pressure and maintain for an additional 3 minutes. Inspect the valve during this procedure for any signs of leakage. Bleed the pressure off of the valve.
5. Reverse the valve and reconnect the pressure source to the opposite side of valve and repeat step #4 making sure all air is evacuated from valve and system.
6. Consult Weir Oil & gas Engineering on any valve not performing properly during any phase of test or operation.

Troubleshooting Guide:

The following is intended as a general guide in helping resolve most problems encountered in repairing plug valves.

| PROBLEM: | SOLUTION: |
|--|--|
| A.) Valve leaks through bore when closed | <ol style="list-style-type: none"> 1. Seal segments from two different manufacturers have been installed. (ALWAYS REPLACE SEGMENTS IN PAIRS FROM THE SAME MANUFACTURER). 2. Sealing area of segments or body scored or pitted. Resurface with 400 grit sandpaper or replace segments and/ or body. 3. Plug scored or worn. Replace plug. 4. ID of body or OD of seal segments not cleaned properly. Remove parts and clean out any contaminants. If the ID of the body is not cleaned properly, this will not let the O-ring or seal segments seat properly. ID of body may be too pitted to reuse. 5. Segments seal left out, not properly installed, or damaged during assembly. Remove segments, inspect seals and reinstall or replace as necessary. 6. Wrong actuator cap installed forcing plug to tilt to one side. Ensure actuator cap is from same manufacturer as body. (Always use SPM[®] actuator caps on SPM[®] valves). |
| B.) Valve will not fully open. | <ol style="list-style-type: none"> 1. Worn or damaged actuator cap or not an SPM[®] actuator cap. Remove and install SPM[®] actuator cap. (Always use SPM[®] actuator caps on SPM[®] valves). |
| C) Valve leaks at body threads. | <ol style="list-style-type: none"> 1. Body cap not tight. Re-tighten. Cap should bottom out. 2. Body cap O-ring scored or cut or no longer maintains seal. Replace O-ring. 3. Body cap damaged or worn. Replace cap. (Always use SPM[®] body caps in SPM[®] valves). 4. On SPM[®] 2inch valves, back-ring not installed. Install back-up ring above the O-ring with concave surface touching the O-ring. 5. Seal area scored or pitted in body. Clean up with 400 grit sandpaper or replace body. |
| D) Seals swollen and softened or tacky. | <ol style="list-style-type: none"> 1. Avoid solvents. Bune-N seals are not compatible with solvents such as toluene or xylene. If Buna seals are used, replace with Viton. |
| E) Lower edge of plug chipped. | <ol style="list-style-type: none"> 1. Always start plug into valve upon reassembly by hand to align chambers on plug and seal segments. Hammering plug before it is properly started can chip the plug's leading edge and often score or damage the seal segments. Use only soft type hammers. |

| PROBLEM: | SOLUTION: |
|---|---|
| F) Valve leaks out the bottom. | <ol style="list-style-type: none"> 1. Body cap not SPM® product. Remove and reinstall SPM® body cap. SPM® bodies and body caps are designed differently to eliminate leaking cap problems. (Always use SPM® body caps in SPM® valves). 2. Actuator cap not SPM® product. Remove and re-install SPM® actuator cap. (Actuator caps from competitor valves will not work properly on SPM® valves). 3. Plug seal O-ring and back-up ring on bottom of plug not seated properly. Remove plug and reinstall O-ring and Nylon back-up ring. |
| G) Valve leaks around plug top stem. | <ol style="list-style-type: none"> 1. Top plug seal O-ring and back-up scored or not seated properly. Replace or re-install. 2. Body cap not properly tightened. Re-tighten snugly until it bottoms out. 3. Body cap damaged or worn. Replace. 4. Body cap not SPM® product. Remove and re-install SPM® body cap. SPM® bodies and body caps are designed differently to eliminate leaking cap problems. (Always use SPM® body caps in SPM® valves). |
| H) Valve binding up. Hard or impossible to open or close. | <ol style="list-style-type: none"> 1. ID of body not clean. Clean body and components. Re-assemble. 2. Pins that hold detent spring may be interfering with actuator cap. Re-tighten pins in body. 3. Actuator cap is not SPM® product or is worn. Remove and install SPM® actuator cap and felt gasket. (Always use SPM® actuator caps on SPM® valves). |



NOTE: IF PROBLEMS ARE NOT RESOLVED BY USING THE TROUBLESHOOTING GUIDE, CONTACT WEIR OIL & GAS FOR ASSISTANCE.



SECTION IV: Service and Support

Service Center Order Information:

Weir Oil & Gas stocks a large inventory of genuine “original equipment” replacement parts. In order to expedite a parts order and avoid any delays, please provide the following information with your order:

- The model number and serial number
- The part number and description (refer to drawings and parts lists in this section) of each item ordered.
- The quantity of each part, kit, or assembly ordered.
- Your purchase order number.
- Specify method of shipment, complete shipping address, complete billing address and telephone number at the destination of the shipment.

Parts and service may be ordered through the following locations.

Weir Oil & Gas

601 Weir Way
Fort Worth
TX 76108
USA

Tel: (817) 246 2461
Fax (817) 246 6324

www.weiroilandgas.com

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Oil & Gas
Solutions



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Deer Park, TX 77536
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Broussard, LA 70518
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Ph: +1-337-837-3161
Fax: +1-337-839-1985

Pleasanton, TX - Service Center
772 HWY 281 South
Pleasanton, TX 78064
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Fax: +1-817-246-3970

Kilgore, TX - Service Center
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Buckhannon, WV 26201
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76 Odell Road
Muncy, PA 17756
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Fax: +1-570-546-2033

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Fort Lupton, CO 80621
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Fax: +1-303-535-5455

Grand Junction, CO - Service Center
842 21 1/2 Rd., Building A
Grand Junction, CO 81505
Ph: +1-970-243-4600
Fax: +1-970-243-8027

Williston, ND - Service Center
5073 Owens Industrial Park
Williston, ND 58801
Ph: +1-701-572-0776
Fax: +1-701-572-0784

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Edmonton, Alberta T6E 5W2
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Fort St. John, BC, Canada - Service Center
10508, 89th Avenue
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